

## **AMENDMENTS TO THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

### **Listing of Claims:**

- 1           1.       (Currently amended) A method for supporting read-only objects  
2       within an object-addressed memory hierarchy, comprising:  
3       |       receiving a request at a translator to access an object, wherein the request  
4       |       includes an object identifier for the object that is used to reference the object  
5       |       within the object-addressed memory hierarchy, and wherein the translator  
6       |       translates between object identifiers (used to reference objects in an object cache)  
7       |       and a physical addresses (used to address objects in main memory);  
8       |       using the object identifier to retrieve an object table entry associated with  
9       |       the object;  
10       |       if the request is a write request,  
11       |       examining a read-only indicator within the object table  
12       |       entry,  
13       |       if the read-only indicator specifies that the object is a read-  
14       |       only object, performing a corrective action to deal with the fact that  
15       |       the write request is directed to a read-only object.  
  
1           2.       (Original) The method of claim 1, wherein if the request is a read  
2       request, the method further comprises using a physical address from the object  
3       table entry to access the object in main memory.

1           3.       (Original) The method of claim 1, wherein performing the  
2 corrective action can involve causing a fault handler in the requesting processor to  
3 perform the corrective action.

1           4.       (Original) The method of claim 1, wherein performing the  
2 corrective action can involve:  
3           obtaining a writable copy of the object, clearing the read-only indicator to  
4 indicate that the object is no longer read-only, and updating the writable copy of  
5 the object with data from the write request;  
6           updating a remotely located master copy of the object with data from the  
7 write request;  
8           terminating the requesting process because the write request is not  
9 allowed; and  
10          if the request is directed to a debugging breakpoint, pausing the requesting  
11 process and clearing the read-only indicator.

1           5.       (Cancelled)

1 |          6.       (Currently amended) The method of ~~claim 5~~claim 1,  
2          wherein prior to receiving the request at the translator, the request is  
3 initially directed to the object cache;  
4          wherein if the request causes a hit in the object cache, the object is  
5 accessed in the object cache and the request is not sent to the translator; and  
6          wherein if the request causes a miss in the object cache, the request is sent  
7 to the translator.

1           7.       (Original) The method of claim 6, further comprising making a  
2 given object read-only by:

3           setting a read-only indicator associated with the given object to indicate  
4   that the given object is read-only;  
5   causing all object caches within a local cache-coherent domain to flush any  
6   modified cache lines of the given object out to main memory;  
7           whereby subsequent upgrades of the given object from read-only status to  
8   writable or modified status in any caches within the local cache-coherent domain  
9   must go through a translator.

1           8.     (Original) The method of claim 7, wherein causing all object  
2   caches within the local cache-coherent domain to flush any modified cache lines  
3   of the given object out to main memory involves executing a read-with-intent-to-  
4   only-read (RWITOR) instruction on each cache line of the given object.

1           9.     (Original) The method of claim 7, wherein the given object can be  
2   made read-only in response to a request received from outside the local cache-  
3   coherent domain.

1           10.    (Currently amended) The method of ~~claim 5~~ claim 1, wherein the  
2   translator includes hardware to translate between object identifiers and physical  
3   addresses.

1           11.    (Currently amended) An apparatus that supports read-only objects  
2   within an object-addressed memory hierarchy, comprising:  
3           a receiving mechanism configured to receive a request at a translator to  
4   access an object, wherein the request includes an object identifier for the object  
5   that is used to reference the object within the object-addressed memory hierarchy,  
6   and wherein the translator translates between object identifiers (used to reference

7 | objects in an object cache) and a physical addresses (used to address objects in  
8 | main memory);  
9 |       a translation mechanism configured to use the object identifier to retrieve  
10 | an object table entry associated with the object; and  
11 |       a corrective action mechanism, wherein if the request is a write request,  
12 | the corrective action mechanism is configured to,  
13 |               examine a read-only indicator within the object table entry,  
14 |               and  
15 |               if the read-only indicator specifies that the object is a read-  
16 | only object, to perform a corrective action to deal with the fact that  
17 | the write request is directed to a read-only object.

1       12.   (Original) The apparatus of claim 11, wherein if the request is a  
2 | read request, the translation mechanism is additionally configured to use a  
3 | physical address from the object table entry to access the object in main memory.

1       13.   (Original) The apparatus of claim 11, wherein the corrective action  
2 | mechanism is configured to cause a fault handler in the requesting processor to  
3 | perform the corrective action.

1       14.   (Original) The apparatus of claim 11, wherein performing the  
2 | corrective action can involve:  
3 |       obtaining a writable copy of the object, clearing the read-only indicator to  
4 | indicate that the object is no longer read-only, and updating the writable copy of  
5 | the object with data from the write request;  
6 |       updating a remotely located master copy of the object with data from the  
7 | write request;

8           terminating the requesting process because the write request is not  
9   allowed; and  
10          if the request is directed to a debugging breakpoint, pausing the requesting  
11   process and clearing the read-only indicator.

1           15.   (Cancelled)

1           16.   (Currently amended) The apparatus of ~~claim 15~~claim 11, wherein  
2   the apparatus includes the object cache;  
3          wherein prior to receiving the request at the translator, the request is  
4   initially directed to the object cache;  
5          wherein if the request causes a hit in the object cache, the object is  
6   accessed in the object cache and the request is not sent to the translator; and  
7          wherein if the request causes a miss in the object cache, the request is sent  
8   to the translator.

1           17.   (Original) The apparatus of claim 16, further comprising a read-  
2   only configuration mechanism configured to make a given object read-only by:  
3          setting a read-only indicator associated with the given object to indicate  
4   that the given object is read-only; and  
5          causing all object caches within a local cache-coherent domain to flush  
6   any modified cache lines of the given object out to main memory;  
7          whereby subsequent upgrades of the given object from read-only status to  
8   writable or modified status in any caches within the local cache-coherent domain  
9   must go through a translator.

1           18.   (Original) The apparatus of claim 17, wherein the read-only  
2   configuration mechanism causes all object caches within the local cache-coherent

3 domain to flush any modified cache lines of the given object out to main memory  
4 by executing a read-with-intent-to-only-read (RWITOR) instruction on each cache  
5 line of the given object.

1 19. (Original) The apparatus of claim 17, wherein the read-only  
2 configuration mechanism makes the given object read-only in response to a  
3 request received from outside the local cache-coherent domain.

1 20. (Currently amended) The apparatus of ~~claim 15~~claim 11, wherein  
2 the translator includes hardware to translate between object identifiers and  
3 physical addresses.

1 21. (Currently amended) A computer system that supports read-only  
2 objects within an object-addressed memory hierarchy, comprising:  
3 a processor;  
4 the object-addressed memory hierarchy;  
5 an object cache within the object-addressed memory hierarchy;  
6 a translator that translates between object identifiers, used to address  
7 objects in the object cache, and physical addresses, used to address objects in  
8 main memory;  
9 a receiving mechanism within the translator configured to receive at the  
10 translator a request to access an object, wherein the request includes an object  
11 identifier for the object that is used to reference the object within the object-  
12 addressed memory hierarchy, and wherein the translator translates between object  
13 identifiers (used to reference objects in an object cache) and a physical addresses  
14 (used to address objects in main memory);  
15 a translation mechanism within the translator configured to use the object  
16 identifier to retrieve an object table entry associated with the object; and

17           a corrective action mechanism, wherein if the request is a write request,  
18 the corrective action mechanism is configured to,  
19           examine a read-only indicator within the object table entry,  
20           and  
21           if the read-only indicator specifies that the object is a read-only object, to  
22 perform a corrective action to deal with the fact that the write request is directed  
23 to a read-only object.